APPENDIX G. ONGOING WATER AND RELATED ENVIRONMENTAL RESOURCE MANAGEMENT PROGRAMS, PLANS, STUDIES, AND REPORTS

This appendix describes basin-wide and regional programs, plans, studies, and reports.

ONGOING PROGRAMS AND PLANS

ONGOING PROGRAMS AND PLANS IN BOTH BASINS

Corps of Engineers, January 1997 Flood Disaster Recovery Plan

The floods of January 1997 in the Central Valley were the largest recorded on many of the rivers and streams in the Sacramento and San Joaquin River watersheds. In response to the flood damages, the Corps was designated to lead an Interagency Task Force to ensure that various interests in the watershed are considered.

This Disaster Recovery Plan had four phases. Its mission was to achieve a rapid, effective response to damaged flood management systems, thereby minimizing risk to life and property, while also ensuring a cost-effective approach to flood damage mitigation and floodplain management and the protection of inherent and adjacent environmental and natural resources. This plan involves Federal agencies, CALFED, and DWR. The plan's phases address short- and long-term needs.

Phase 1 of the recovery plan was the Emergency Response Phase to address immediate emergency needs during flooding. The Corps, in close coordination with DWR, provided materials and technical assistance to fight the floods. Phase 1 ended when the immediate emergency passed. Repair of damaged levees and other flood management structures was then necessary.

The repair of damaged levees was undertaken in the next two phases of the plan, the Initial Recovery Phase (Phase 2), and the Final Restoration Phase (Phase 3). Initial efforts were made to close breaches and rehabilitate levees to provide an interim level of flood protection (roughly a 20 - 25-year level) through the end of May 1997. Efforts to fully restore the pre-flood levels of protection were essentially completed by the start of the next flood season, October 1, 1997, though some activity continues. Additional cost-shared work was authorized for the Phase 3 effort in December 1997. This work corrects pre-flood problem areas that could fail during future floods. Only areas that contain critical facilities or a substantial urban area are being corrected under this work.

Guidance from the Executive Office for the repair and reconstruction of the levees was provided to ensure that all relevant options, including non-structural alternatives, were considered. A non-structural task force was formed to consider the following factors in the evaluation of applications for levee repair and associated restoration: non-structural alternatives to reduce future flood damages to the applicant and to adjacent upstream and downstream localities; reduction of long-term costs to taxpayers; improvement of environmental conditions, including water quality; and assisting public and private landowners in fulfilling their conservation objectives or obligations related to protected species, wetland restoration, and riparian habitat protection.

An additional phase was necessary to complete the evaluation of the flood management systems for both basins. The Comprehensive Study represents the fourth phase of the 1997 Flood Disaster Recovery Plan.

Flood Emergency Action Team (FEAT) Report/Floodplain Management Task Force

An important recommendation of the Governor's 1997 FEAT Report was for the Governor to appoint a Floodplain Management Task Force with broad membership from sectors of government and from the affected communities. This task force would examine management strategies related to State and local floodplain management, and make recommendations for improved statewide floodplain management policies.

In addition, the Task Force was asked to explicitly respond to the following recommendations:

1. Review the roles and responsibilities of The Reclamation Board and recommend legislative changes to improve responsiveness to flood management needs in the Central Valley.

2. Examine Federal and State floodplain management regulations. Recommend changes to the State's existing floodplain management procedures and policies that are implemented through Executive Order.

3. Review The Reclamation Board's Designated Floodway program. Recommend changes to the program.

4. Examine the option of requiring that future urban developments exceed the minimum floodplain management elevation requirements set by the National Flood Insurance Program (NFIP). State standards in statute would be imposed for this option.

5. Examine the possibility of requiring mandatory flood insurance for structures that are protected at less than the 200-year level of protection in statute.

6. Develop specific multi-objective watershed planning elements that should be added to the Safety Element of the State's General Plan Guidelines. These elements would encourage a regional/coordinated approach for land use planning decisions.

7. Evaluate land use policies applicable to urban development in deep floodplains and other high flood risk areas. Recommend methods of regulation, such as requiring notice on property titles to ensure that prospective buyers are given notice of potential hazards.

8. Review the situation that occurs when a Local Maintenance Area's maintenance is deficient. Recommend a course of remedial action for the State.

9. Develop pro-active, nonstructural floodplain management strategies that can be implemented cooperatively with local government and landowners to reduce future flood loss and curtail the increasing cost of State and Federal disaster assistance.

10. Examine the advisability of providing an incentive by requesting the Legislature to amend the State's programs for State participation in Federal flood management projects so that funding is provided only for those communities that adopt and implement local floodplain management measures.

The Reclamation Board's Designated Floodway Program

Development along approximately 1,300 miles of major streams, and selected minor streams, within the Sacramento and San Joaquin Valleys are regulated by standards of The Reclamation Board's Designated Floodway program.

This program is authorized by the California Water Code, Section 8609. Rules and regulations are set forth in Title 23, California Code of Regulations. The Reclamation Board does not recognize a floodway fringe. In other words, the floodway limits and the boundary of the 100-year floodplain are identical. However, some designated floodway regulations relating to encroachment and to water level rise are different from the FEMA regulations.

Certain applications may be permitted in The Reclamation Board's designated floodway provided that alone, or cumulatively, in the judgement of The Board, they will not unduly impede the free flow of water in the floodway or jeopardize public safety. Structures that are designed to have a minimum effect upon the flow of water and are firmly anchored to prevent the structure from flotation may be permitted. Structures for year-round human habitation are generally not permitted. In some instances, The Reclamation Board has designated floodways using less than the 100-year flow.

Other Floodplain Management Programs

A number of major floodplain management (FPM) activities are currently underway. A summary of these activities and their associated programs follows.

- A three-year study is being conducted by DWR in coordination with other agencies to examine floodplain function. A grant from the U.S. Environmental Protection Agency (EPA) to DWR was approved in October 1997. A working group of representatives from the agencies has met on a regular basis to coordinate and direct the efforts of the study. Four Federal and six State agencies are involved in the study, along with an advisory group from U.C. Davis. This study focuses on a growing need to implement a non-structural approach to floodplain management by restoring natural floodplain functions, conserving and enhancing floodplain resources, and publicizing floodplain resources. A key element is the development of an economic framework to estimate the benefits and costs of multi-objective floodplain management plans. This framework will assist in interpreting the complex relationships between floodplain structure, functions, and values and will help to identify benefits and adverse impacts.

- The State Office of Planning and Research (OPR) is responsible for updating and publishing the Guidelines for the State General Plan. OPR has recently released the 1998 State General Plan Guidelines that cover preparation and adoption of an optional Floodplain Management Element for inclusion in city and county general plans. These new guidelines will strongly encourage local governments to adopt and improve appropriate floodplain management measures.

- Another published document for local public administration of floodplain management programs is a model Floodplain Management (FPM) ordinance prepared by the State DWR. This ordinance contains language that covers all minimum requirements for communities in adhering to regulations in the NFIP. Each community participating in the NFIP must have an adopted FPM ordinance. The community may use the model ordinance as is, or make changes to fit local conditions, if approved by FEMA.

- Another DWR action is to assist local communities to help them meet their floodplain management and mapping needs. Although FEMA has issued Flood Insurance Rate Maps for communities that are participating in the NFIP, changes in conditions such as land-use, hydrology, and other factors, require updates of those maps. Although FEMA has an on-going program to periodically update these maps, communities need assistance from the State. DWR has received funding for community mapping and update assistance.

- Public information about floodplain management programs is essential. Consequently, Federal agencies are providing floodplain management information to the public, to State and local elected officials, and to community personnel. Training and public outreach efforts are also part of this public information campaign.

- Minimum structural requirements for development in the floodplain for the NFIP are documented in the Code of Federal Regulations. Nearly all California communities have adopted these standards in a local FPM ordinance. Over the years, these NFIP structural requirements have been included independently in each of the three building codes used in the United States. The American Society of Civil Engineers (ASCE) recently completed a complex effort which led to the creation of a new national standard for flood-resistant design and construction of structures located in flood prone areas. Standard 24-98 requires that essential minimum criteria be used in coastal and riverine flood hazard areas. This mandatory standard is suitable for reference in all State and local codes, and will be of significant help in the design and construction of flood-resistant structures.

CALFED Bay-Delta Program and Ecosystem Restoration Program

On December 15, 1994, State and Federal agencies, working with agricultural, environmental and urban stakeholders, reached agreement on water quality standards and related provisions that would remain in effect for three years. This agreement, known as the Bay-Delta Accord, was based on a proposal developed by the stakeholders. The 1994 Bay-Delta Accord is reflected in the State Water Resources Control Board's, "Draft Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary," dated December 1994, and the Final Water Quality Plan, which was adopted May 22, 1995. The Accord was extended in 1997 for one year, and again in 1998, to allow the CALFED Bay-Delta Program to continue working with stakeholders to develop a long-term solution for problems in the Bay-Delta system.

The CALFED Bay-Delta Program (CALFED) was established in May 1995 as a cooperative effort among the State and Federal agencies which handle management and regulatory responsibilities in the Delta. The five Federal agencies are the Bureau of Reclamation, the FWS, the National Marine Fisheries Service (NMFS), the EPA, and the Corps. The non-Federal agencies are DFG, DWR, and the State Water Resources Control Board.

Provisions of the program are intended to reconcile water supply operational flexibility and compliance with the Federal Endangered Species Act (ESA). Compliance with provisions of the ESA is intended to result in no reduction in water supply from what would be available for export under other operational requirements of the agreement. This compliance will be accomplished in part by better monitoring for the presence of aquatic organisms of concern; faster interpretation of monitoring information; and immediate response in the operation of export facilities. This approach is known as real-time monitoring. Operators of the California

State Water Project (SWP) and the Federal Central Valley Project (CVP) recognized that compliance with endangered species protections, water quality standards, and provisions of the Central Valley Project Improvement Act would require that project operations be coordinated even more closely than in the past. To help ensure this coordination, representatives of the two projects and the other CALFED agencies meet regularly to manage day-to-day project operations. The deliberations of this Operations Group are conducted in consultation with water user, environmental, and fishery representatives.

The Framework Agreement also called for a joint State-Federal process to develop long-term solutions to problems related to fish and wildlife in the Bay-Delta Estuary, water supply reliability, natural disasters, and water quality. A comprehensive and balanced plan is sought to address all of the resource problems.

The CALFED Policy Group, a broad coalition of State and Federal agencies with responsibility in the Bay-Delta Estuary, provides direction to the program and ensures that decisions and actions are consistent with the goals and objectives of the participating agencies. The Bay-Delta Advisory Council (BDAC) consists of over 30 water leaders representing California stakeholder groups. BDAC is chartered under the Federal Advisory Committee Act, and members are appointed by the Governor and Secretary of the Interior. BDAC meets regularly to provide input and advice to the program.

The Bay-Delta program will develop long-term measures to handle problems affecting the Bay-Delta estuary. The program focuses on four objectives:

- To provide optimal water quality;
- Ecosystem Restoration: Improve and increase aquatic and terrestrial habitats; improve ecological functions in the Bay-Delta estuary to support sustainable populations of diverse plant and animal species;
- Water Supply Reliability: Reduce the shortages between water supplies and current and projected demands on the system.
- Delta Levee System Reliability: Reduce the risk of total failure of levees that protect land use and associated economic activities, water supply and other infrastructure, and ecosystems.

Six major long-term programs have been proposed as common elements to meet the aforementioned objectives:

- Water Quality Program
- Ecosystem Restoration Program

- Water Use Efficiency Program
- Water Transfers
- Watershed Management Coordination
- Long Term Delta Levee Protection Plan.

The CALFED Ecosystem Restoration Program Plan (ERPP) and subsequent Strategic Plan have established the framework and philosophy on ecological functions, processes, habitats, species, and stressors applicable to the study area to meet the second objective. These plans constitute a long-term, ecosystem restoration program that will be implemented in phases over several decades. The implementation area is not confined to the Delta but includes the Sacramento and San Joaquin watersheds and large areas of California. CALFED's Category III and subsequent Restoration Coordination Projects programs develop and fund non-flow-related ecosystem restoration. A total of 71 projects at a cost of over $85 million were approved for FY-1997. Sixty-two proposals were funded for FY-1998, totaling approximately $25.3 million. The Comprehensive Study Team maintains close coordination with CALFED to discuss restoration projects which could improve the flood management system of the study area.

The Comprehensive Study may provide support for CALFED objectives. The Corps, the State, and the CALFED agencies are working together to develop and implement plans for flood damage reduction, floodplain management, and ecosystem restoration.

Central Valley Project Improvement Act (CVPIA) Anadromous Fish Restoration Program

Section 3406(b)(1) of the CVPIA calls for the development and use of "a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991 ..." This program is under development and is known as the Anadromous Fish Restoration Program (AFRP). The FWS is in charge of developing the AFRP. The plan for the program is being written under the direction of the Sacramento-San Joaquin Estuary Fishery Resource Office.

CVPIA Land Retirement Program

The CVPIA Land Retirement Program is limited to willing buyer/willing seller transactions with a preference for drainage-impaired lands in the CVP service area. Land retirement purchases will occur in two ways: (1) the Bureau of Reclamation (Reclamation) will purchase the land and water, and make the water available for direct environmental benefit or delivery into storage as part of the Water Reserve Account; or (2) Reclamation will purchase the land only, and the water will remain with the water district. Land retirement purchases will be based on fair market value in either case.

In response to a Request for Proposals (RFP) issued by Reclamation in 1997, there were 31 offers to sell drainage-impacted lands totaling 27,500 acres. Reclamation anticipates funding purchases of approximately 12,500 acres. Additional funding may be available from water districts that choose to partner with Reclamation in land retirement purchases. Under such arrangements, the Department of Interior will jointly, with the water district, investigate the possibility of purchasing additional lands on the west side of the San Joaquin Valley with willing partners. Under these partnerships, Reclamation will use the water acquired during wet years for either direct environmental benefit (including refuge supplies) or for storage in the Water Reserve Account. For years other than wet years, the water will be available for use by the partner.

In 1998, Reclamation issued a second RFP to identify additional lands for purchase during the next 5 years. Funding for purchases from willing sellers of an additional 40,000 acres of land will be approximately $50 million. The CALFED water quality program has set a target of 90,000 acres for land retirement, and acquisitions under the second RFP would be coordinated with CALFED.

The disposition of water from the Land Retirement Program depends on whether Reclamation acquires land and water, or only the land. It is not anticipated that a significant amount of water will be made available to the Reclamation from the Land Retirement Program.

Environmental benefits of the program include: (1) taking drainage-impacted land out of production, and reducing salt and selenium loading; (2) creating upland habitat; and (3) shifting demand for water from agricultural use on predominantly drainage-impacted lands to storage in the Water Reserve Account or other environmental needs. Water districts that retain water made available through land retirement will be prohibited from using the water on drainage-impacted lands.

The CVPIA Land Retirement Program will allow for financial participation by water districts. Participating districts will benefit by retaining the water for use in improving their supply reliability on nondrainage-impacted lands.

North American Waterfowl Management Plan/California Central Valley Habitat Joint Venture Plan

Through an agreement in 1986 between the United States and Canada, partnerships have been formed between Federal and State agencies, private conservation organizations, and individuals to restore waterfowl and other migratory bird populations to the levels of the 1970's. The Central Valley is the most important waterfowl wintering area in the Pacific Flyway, for it supports about 60 percent of the total population. The Central Valley has thus been designated as a priority habitat range, and the California Central Valley Joint Venture has been formed to protect, maintain, improve, and restore wetland habitats for waterfowl nesting, migrating, and

wintering in order to increase waterfowl populations. The joint venture also protects existing wetlands through acquisition, secures additional water supply, increases wetland areas, and enhances waterfowl habitats on existing public and private lands. Congressional recognition of the plan comes from the North American Wetlands Conservation Act of 1989.

Partnerships of Federal and State agencies, private conservation organizations, and individuals have been formed to accomplish specific goals for the Central Valley. These goals are to:

- Enhance wetland habitats on 291,555 acres of public and private lands;
- Enhance waterfowl habitat on 443,000 acres of agricultural lands;
- Protect 80,000 acres of existing wetlands acres and protect them in perpetuity by acquisition of fee-title or conservation easement;
- Secure an incremental, firm water supply that is of suitable quality and is delivered in a timely manner for use by national wildlife refuges, State wildlife areas, and the Grasslands Resource Conservation District;
- Secure Central Valley project power for national wildlife refuges, State wildlife areas, the Grasslands Resource Conservation District., and other public and private lands dedicated to wetland management.

California Riparian Habitat Joint Venture

California Partners in Flight launched the Riparian Habitat Joint Venture (RHJV) on September 6, 1994. The California Partners In Flight (PIF) program was originally launched to join State, Federal, and private groups to stop the decline of migratory birds. PIF created a broad coalition of conservationists, researchers, teachers, land managers, and the general public.

The RHJV's goal is to conserve, increase, and improve riparian habitat to protect and enhance California's native resident birds and neotropical migratory birds. By developing a coordinated statewide effort, increasingly fragmented habitat patches will be replaced with an extensive network of riparian forests capable of supporting viable breeding populations of native birds. A wide variety of other species of plants and animals will benefit through the protection of forests along California's rivers, streams and lakes. The six objectives of the RHJV are:

- Compile existing information on riparian habitat throughout the State to identify key riparian areas, as well as information gaps. Promote and coordinate efforts to obtain the information;

- Develop guidelines for the protection of existing riparian habitat on public lands and recommend alternative for protection of habitat on private lands;

- Restore riparian habitat on public and private lands using commonly accepted, scientifically valid restoration techniques;

- Enhance the productivity and biodiversity of riparian communities using appropriate management techniques;

- Establish a network of high-quality riparian habitats throughout California to enhance and protect native birds;

- Inform the public and resource managers about the value of California's riparian habitat;

Recently, the RHJV Technical Committee decided to establish a quantifiable riparian restoration goal. Their goal is to double the existing riparian habitat which is providing effective habitat for resident and migratory landbirds, and to enhance 25 percent of the habitat which is now considered degraded. RHJV plans on achieving this goal by the year 2008. RHJV is in the process of establishing selection criteria for pilot riparian acquisition and restoration projects. The RHJV will work with established partnerships, and public and private landowners to develop, fund, and implement a network of functional riparian corridors throughout the State.

1994 NFIP Reform Bill

The Community Development and Regulatory Improvement Act of 1994, P.L. 103-325, contains important changes to the National Flood Insurance Program, and became known as the 1994 NFIP Reform Bill. The bill contains the following provisions dealing with aspects of the NFIP:

- To be eligible for flood mitigation grants, states and communities must develop "mitigation plans" that include a strategy for implementation of hazard-mitigation measures;

- Flood insurance coverage must include the increased cost of compliance with land use and control measures adopted by states or communities. FEMA is limited to charging not more than $75 per flood insurance policy to provide hazard mitigation insurance coverage;

- FEMA is directed to complete a study of communities likely to be identified as having erosion hazard areas, to assess the economic impact of erosion on the NFIP, and to make a determination of costs and benefits of expenditures to complete erosion mapping;

- Receipt of Federal flood disaster relief assistance is predicated upon the coverage of the damaged structure by flood insurance;

- Financial institutions must give written notification to buyers of residential structures in Special Flood Hazard Areas (SFHA) of the NFIP requirement to obtain flood insurance. This reporting requirement applies to Federally-insured lending institutions and to credit unions. In some instances, lenders may charge a reasonable fee to determine if a property is in the SFHA.

- The Community Rating System (CRS) was authorized to provide incentives to communities for having measures in place to reduce the risk of flood or erosion damage that exceed Federal minimum criteria in the NFIP.

- A Technical Mapping Advisory Council was established with members from Federal agencies and floodplain management groups, map determination firms, and engineering and surveying professionals. The Council makes recommendations to FEMA on the accuracy, quality, digitization, use and distribution of flood insurance rate maps, and mapping standards and guidelines. Periodic assessment of the need to update flood and erosion hazard areas was set at five years.

- Other provisions increased maximum flood insurance coverage to $250,000 for residential structures, $100,000 for residential contents, and $500,000 each for non-residential structures and contents. The waiting period to initiate coverage was extended to thirty days (formerly five days).

Clean Water Action Plan

The goal of this new Federal program is to improve water quality by strengthening public health protections, targeting community-based watershed protection efforts at high priority areas, and providing communities with new resources to control polluted runoff.

In 1997, the EPA and the U.S. Department of Agriculture (USDA) were authorized to work with other Federal agencies and the public to prepare a plan to improve water quality. The Action Plan strengthens efforts to restore and protect water resources. In implementing this plan, the Federal government will:

- support locally led partnerships that include Federal agencies, States, tribal groups, communities, businesses, and citizens to meet clean water and public health goals;

- increase financial and technical assistance to States, tribal groups, local governments, farmers, and others; and

- help States and tribal groups restore and sustain the health of aquatic systems on a watershed basis.

The Conservation Reserve Program

Severe erosion of America's cropland results in soil losses at a rate exceeding 3 billion tons per year. Intensive farming and the widespread conversion of fallow land to production have had an adverse effect on wildlife by destroying habitats for many species, leading to declining populations. Therefore, USDA implements the Conservation Reserve Program (CRP). The CRP entails voluntary partnerships between individuals and the Federal government. The program provides incentives and assistance to farmers and ranchers for establishing conservation practices that have a beneficial impact on resources both on and off the farm. It encourages farmers to voluntarily plant permanent covers of grass and trees on land that is subject to erosion, where vegetation can improve water quality or provide food and habitat for wildlife.

As of October 1, 1996, more than 36 million acres had been enrolled in the CRP. Of the total acreage enrolled, 2.5 million acres are planted to trees, and 2 million acres are converted to wildlife practices, including wildlife habitat and special shallow water areas. In addition, there are now roughly 8,500 miles of CRP filter strips along bodies of water, and 32.3 million CRP acres devoted to grass cover. The CRP safeguards topsoil from erosion, increasing wildlife habitat, and protecting ground and surface water by reducing water runoff and sedimentation.

Emergency Watershed Protection Program

The Natural Resources Conservation Service (NRCS) administers this program to provide landowners and the public with an alternative to restoring frequently flood-damaged lands to agricultural production through the use of public funds to purchase floodplain easements. Potentially eligible lands include agricultural lands damaged by flooding that have either been subject to repeated flood damage or are located where flooding can be expected to recur. This program is intended to provide a more permanent solution to repetitive disaster assistance payments and to achieve greater environmental benefits where the situation warrants, and where the affected landowner is willing to participate in the easement approach.

Other NRCS Programs

The NRCS has several additional programs for conserving land, and related water and environmental resources. Some of these programs include:

Wildlife Habitat Incentives Program (WHIP). This program provides financial incentives to develop habitat for fish and wildlife on private lands. Participants agree to implement a wildlife habitat development plan and the Federal government agrees to provide cost-share assistance for the initial implementation of wildlife habitat development practices. Program participants enter into a cost-share agreement with the USDA for wildlife habitat development. This agreement generally lasts for five to ten years from the date that the contract is signed. The WHIP emphasizes: 1) fish and wildlife habitats of National and State significance; 2) habitats of declining fish and wildlife species, including rare and threatened and endangered species; and 3) benefiting fish and wildlife species that may not otherwise be funded.

Environmental Quality Incentives Program (EQIP). This program provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and it encourages environmental enhancement. The program is funded through the Commodity Credit Corporation. The purposes of the program are achieved through the implementation of a conservation plan which includes structural, vegetative, and land management practices on eligible land. Five- to ten-year contracts are made with eligible producers. Cost-share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices, such as nutrient management, pest management, and grazing land management. Fifty percent of the funding available for the program is targeted at natural resource concerns relating to livestock production. The program is carried-out primarily in priority areas that may be watersheds, regions, or multi-state areas, and for significant statewide natural resource concerns that are outside of geographic priority areas.

Farmland Protection Program (FPP). This program provides funds to help purchase development rights to keep productive farmland in agricultural uses. Working through existing programs, USDA joins State, tribal, or local governments in acquiring conservation easements or other interests from landowners. USDA provides up to 50 percent of the fair market easement value. To qualify, farmland must: be part of a pending offer from a State, tribe, or local farmland protection program; be privately owned; have a conservation plan; be large enough to sustain agricultural production; be accessible to markets for what the land produces; have adequate infrastructure and agricultural support services; and have surrounding parcels of land that can support long-term agricultural production. Depending on funding availability, proposals must be submitted by the government entities to the appropriate NRCS State Office during the application window.

Flood Risk Reduction Program (FRR). This program was established to allow farmers who voluntarily enter into contracts to receive payments on lands with high flood potential. In return, participants agree to forego certain USDA program benefits. These contract payments provide incentives to move farming operations from frequently flooded land.

Small Watershed Program and Flood Prevention Program. This program works through local government sponsors and helps participants solve natural resource and related economic problems on a watershed basis. Projects include watershed protection, flood prevention, erosion and sediment control, water supply, water quality, fish and wildlife habitat enhancement, wetlands creation and restoration, and public recreation in watersheds of 250,000 or fewer acres. Both technical and financial assistance are available.

Wetlands Reserve Program (WRP). The WRP was authorized by the 1990 Farm Bill and is administered by the NRCS, in concurrence with the Farm Service Agency, and in consultation with the USFWS and other cooperating agencies and organizations. The objectives are to: 1) purchase conservation easements from, or enter into cost-share agreements with willing landowners; 2) help eligible landowners protect, restore, and enhance the original native vegetation, hydrology, and natural topography of lands; 3) restore and protect the values and functions of wetlands in agricultural lands; 4) help achieve the national goal of no-net-loss of wetlands; and 5) improve the general environment of the country. The emphasis of the WRP is to attain: 1) habitat for wildlife and migratory birds, including threatened and endangered species; 2) protection and improvement of water quality; 3) attenuation of water flows due to flooding; 4) recharging of ground water; 5) protection and enhancement of open space and aesthetic quality; 6) protection of native flora and fauna that contribute to the nation's heritage; and 7) contribution to educational and scientific scholarship. Funding for this program is from annual appropriations plus a match by the private landowner. Owners of farmed wetlands and cropland converted from wetlands prior to December 23, 1985 are eligible to participate in this program.

Implementation Plan, State of California Watershed Protection and Restoration Council

This plan was prepared in November 1998 by the Watershed Protection and Restoration Council. It documents actions implemented or proposed by the WPRC. Goals include:

- developing watershed assessments;
- coordinating government policies and programs;
- developing and implementing a program to monitor the status of stream, fishery, and watershed resource values;
- documenting State-level efforts;
- providing support to local government and community efforts; and
- recommending roles of Federal agencies.

Land and Water Conservation Fund (LWCF)/National Wetlands Priority Conservation Plan

This program is administered by the National Parks Service. It contributes to national

conservation policies, including resource re-investment (recycling the proceeds of natural resources development back into the protection of natural resources); promotion of State leadership in recreation development (through partnerships with Federal and local governments); and long-term resource protection through permanent, national recreation estates.

Over 37,000 grants to states and localities have been approved under the LWCF grants program for acquisition, development, and planning of outdoor recreation opportunities in the United States. Locally-sponsored grants have supported purchase and protection of 2.3 million acres of recreation lands and the development of nearly 27,000 basic recreation facilities in every state and territory of the nation.

In addition to grants to State and local governments, LWCF has provided more than $5.5 billion to acquire new Federal recreation and conservation lands. These lands form parts of national park, forest, wildlife refuge, river and trail systems.

Other Federal agencies cooperating in LWCF include FWS, BLM, and USFS. The fund purchases wetlands for the agencies according to a prioritized list developed annually as the National Wetlands Priority Conservation Plan.

PROGRAMS AND PLANS IN THE SACRAMENTO RIVER BASIN

SB1086 Upper Sacramento River Fisheries & Riparian Habitat Management Plan

In 1989, the State Resources Agency adopted a plan prepared by the Upper Sacramento River Fisheries and Riparian Habitat Advisory Council to protect, restore, and enhance the fish and riparian habitat and associated wildlife of the upper Sacramento River. The Advisory Council was established in 1986 by State Senate Bill 1086, and it consists of 25 members of Federal, State, and local agencies and environmental, fishery, and landowner groups interested in the environmental resources of the portion of the Sacramento River and its tributaries between the Feather River and Keswick Dam (Verona to Redding, approximately 220 river miles). In response to declines in fish runs on the Sacramento River, the plan outlines 22 restoration proposals/action items. Two items involve protection and restoration of riparian habitat (including shaded riverine aquatic habitat), and the other items involve handling fishery problems (such as declining spawning gravel and increasing river water temperature). Most of the fish restoration actions are being implemented, such as fish bypass structures at diversions on Sacramento River tributaries and a temperature control structure at Shasta Dam. Other proposals require new Federal or State authority and funding.

The "Draft Sacramento River Conservation Area Handbook" was produced by the SB1086 Riparian Habitat Committee. This committee also recommended the creation of a new non-profit management entity with the primary responsibility of implementing the riparian habitat strategy contained in the 1989 Upper Sacramento River Fisheries and Riparian Habitat

Management Plan, and in the handbook. A Memorandum of Agreement is under review by different agencies who through this agreement will support the riparian habitat strategy outlined in the handbook.

Sacramento River Discovery Center

The Sacramento River Discovery Center (SRDC) is located at Lake Red Bluff. It is an educational center that provides opportunities for learning about the Sacramento River watershed. The SRDC provides information ranging from general overviews to detailed research by students and community groups.

The SRDC's goals are to:

- Show that the evolution of the river and the balanced use of its water is not static, but dynamic, and is often a struggle of competing interests.
- Provide a place to be part of on-going research which supports understanding and restoration of river systems/watersheds and to interpret that research to the public.
- Provide a place to improve public viewing of fish.
- Provide a place for groups to gather for education/information experiences.
- Provide a place to coordinate activities on the 500-acre site.
- Provide a place to expand partnerships with public and private organizations to inform and educate the public about natural resource management and recreational opportunities along the river.

The SRDC gathers and distributes information using field and Internet technology. The SRDC also provides educational programs, including training programs for kindergarten and elementary school teachers; day visits for students in kindergarten through second grade; camping visits and trips for students in grades three to eight; and a Natural Resource Academy in which high school and college students serve internships. The academy works with Red Bluff Union High School, Shasta College, and Lassen Volcanic National Park. Development and implementation of plans for the management of a 500-acre riparian forest/wetland is being coordinated by the SRDC Planning Committee, which is made up of representatives from 48 agencies and organizations. Funding for the SRDC is facilitated by a non-profit public benefit corporation.

Sacramento River Watershed Program

The Sacramento River Watershed Program (SRWP), initiated in 1995, is a collaborative effort to address water quality problems on the Sacramento River through water quality/pollutant source monitoring, field sampling and lab analyses, and toxicity monitoring. Stakeholders include representatives of local municipalities and districts, State and Federal agencies, agriculture, industry, landowners, environmental organizations, universities,

technical consultants, watershed conservancies, and the public. The program was formed in part by the Sacramento River Toxic Pollutant Control Program. The SRWP is also developing water quality management strategies to reduce toxic pollutants in the river. The program's mission statement is:

> *To ensure that current and potential uses of the watershed's resources are sustained, restored, and where possible, enhanced, while promoting the long-term social and economic vitality of the region.*

The SRWP is developing a long-term monitoring program for the watershed, which will include toxicity testing. There are currently thirteen sampling sites located in the basin on the Sacramento River (six sites), the Pit River, the McCloud River, the Feather River, the American River, Arcade Creek, the Colusa Basin Drain, and Sacramento Slough.

Contact agencies for the SRWP include the Central Valley Regional Water Quality Control Board, the Sacramento Regional County Sanitation District, and the U.S. Environmental Protection Agency.

PROGRAMS AND PLANS IN THE SAN JOAQUIN RIVER BASIN

San Joaquin River Management Program

The State of California in 1990 established a program to solve water-use problems within the San Joaquin River system. An Advisory Council and an Action Team representing a wide range of Federal, State, and local agencies and private interests prepared a management plan for the river. The plan is documented in a report called the San Joaquin River Management Plan. This plan entails 47 projects, 24 studies, and 3 acquisition goals to improve water quality, water supply, flood protection, recreation, fisheries, and wildlife habitat. The California Resources Agency was the proponent for the plan, which, in 1994, received authorized funding.

San Joaquin River Riparian Habitat Restoration Program

This program is a collaborative effort of the Friant Water Users Authority, Natural Resource Defense Council, Pacific Coast Federation of Fishermen's Associations, U.S. Bureau of Reclamation, and the FWS, with additional participation from other local and State agencies, special districts, conservation groups, and private landowners. The purpose of this program is to plan and implement improvements to environmental conditions along the San Joaquin River, with special emphasis on mutually acceptable riparian habitat restoration projects and management prescriptions.

PRIOR AND ONGOING STUDIES AND REPORTS

Prior studies on the Sacramento and San Joaquin River basins have produced much data, and analysis of changes, problems, and opportunities for these two basins. These studies have addressed flood issues, environmental issues, and land use issues, and the interactions among them. While reporting of information has been helpful to the Comprehensive Study Team, ongoing discussions and review of current data are necessary to apply advanced hydrologic techniques and to determine the benefits of integrating ecosystem restoration into flood damage reduction.

The Comprehensive Study Team has also used these previous studies to identify stakeholders and thus obtain input regarding problems, objectives, and potential measures. Coordination with the various interests has also been helpful in identifying sources of resistance to change, lack of consensus issues, and roadblocks to implementation of desired measures.

Appendix A provides information on basin-wide, regional, and local studies and reports that have been identified through local support group meetings.

STUDIES AND REPORTS FOR BOTH BASINS

Governor's Flood Emergency Action Team Final Report

The State of California completed this report in May 10, 1997 in response to the January 1997 floods. The Governor of the State of California formed the Flood Emergency Action Team (FEAT) to evaluate existing flood management facilities and emergency agency responses and to make recommendations for improving the system in both the short- and long-term. The FEAT consisted of representatives of 13 State agencies involved in emergency and flood management.

The Final FEAT Report made 15 emergency response recommendations, 15 floodplain management recommendations, and 25 flood management system restoration and improvement recommendations to meet short-term needs. The FEAT report also recommended that ten studies be made, including the development of a new comprehensive master plan for flood management in the Central Valley, by the Corps and the State. The Comprehensive Study will accomplish the development of this master plan. The FEAT report also recommended that a Floodplain Management Task Force be appointed to "examine specific issues related to State and local floodplain management and to make recommendations for improved statewide floodplain management policies."

Multi-Objective Approaches to Floodplain Management On A Watershed Basis Study

This study is being conducted by DWR and is being coordinated with the California interagency Floodplain Management Coordination Group (FMCG, see Glossary) and with assistance from the U.C. Advisory Committee Water Resources Center. Its goals are to:

- Develop a comprehensive course concerning multi-objective floodplain management on a watershed basis for local agencies, with emphasis upon the use of benefit/cost analysis and the valuation of non-market effects;

- Develop strategies and/or guidance on including multi-objective floodplain management into each community's General Plan; and

- Develop an educational module for presentation at workshops and other outreach events to assist local multi-objective floodplain management on a watershed basis.

The emphasis of the economic analysis is on providing a framework for quantifying the benefits of maintaining and restoring natural floodplain functions.

Products of the study will include:

- a *Floodplain Management Training Manual* for local agencies that will provide information on (1) multi-objective floodplain management planning process; (2) implementation strategies and guidelines; (3) economic (benefit/cost) analysis; (4) non-market valuation techniques; and (5) public and private technical and funding assistance programs (to be funded outside of this study);

- State General Plan (Floodplain Management Element) guidelines;

- an educational package (computer program, video, powerpoint presentation, written materials) and statewide workshops; and

- post-study formation of economics support staff within DWR to provide technical assistance to local agencies.

The study was initiated in October 1997. To date, the State General Plan (Floodplain Management Element) guidelines have been completed by the Governor's Office of Planning and Research. The development of the economic analysis framework, review of case studies, and other work is in progress. The final report is scheduled for 2000.

Draft Programmatic Environmental Impact Study, Central Valley Project Improvement Act (CVPIA)

This study began in January 1993, and is currently under public review. The Bureau of Reclamation and FWS are to implement the CVPIA, which amends the previous authorizations of the California Central Valley Project (CVP). The current act now includes fish and wildlife protection, restoration, and mitigation as project purposes sharing equal priority with irrigation and domestic water supply uses; fish and wildlife enhancement shares an equal priority with power generation. The Draft Programmatic Environmental Impact Statement (PEIS) addresses the potential impacts of implementing the CVPIA. The PEIS was prepared pursuant to the National Environmental Policy Act (NEPA) by the U.S. Bureau of Reclamation for the Department of the Interior.

The PEIS makes no specific recommendations. There are 19 programmatic actions, and the impacts of each action on resources in the Central Valley. The PEIS assists with comparisons between specific actions and programmatic actions, and their impact on ecosystems in the Central Valley.

SACRAMENTO RIVER BASIN STUDIES AND REPORTS

Draft Sacramento River Conservation Area Handbook

This handbook was completed in May 1998 by the SB1086 Advisory Council's Riparian Habitat Committee. It describes the river processes and riparian habitat formation processes along the Sacramento River from Verona to Keswick. The river is divided into four reaches; descriptions are given for current river conditions for each reach. Developed restoration strategies for each reach are described for the preservation and re-establishment of a continuous riparian ecosystem along the Sacramento River in the following manner:

- local, State, and Federal-sponsored flood control and bank stabilization programs must have full consideration;
- landowner, public, and local government concerns must be considered; and
- a cooperative and comprehensive management program must strive to preserve the ecosystem over the long term.

No specific project recommendations are made in the handbook. A restoration strategy for riparian habitat conservation is proposed for each reach.

Reconnaissance Report, Upper Sacramento River Fish and Wildlife Habitat Restoration, California

The Corps completed this reconnaissance report in March 1994. The report determined the potential for Federal participation in preserving and restoring fish and wildlife habitat affected by the construction and operation of three flood control projects: (1) Sacramento River Flood Control Project; (2) Sacramento River Bank Protection Project; and (3) Sacramento River, Chico Landing to Red Bluff Project.

The conclusions and recommendations of this report are as follows:

- Environmental resources have seriously declined as a result of past flood control and water resources development in the study area. Consequently, a Federal interest exists for fish and wildlife habitat restoration.

- Site-specific restoration plans can be developed within the limits of the existing flood control project with no significant impacts on flow conveyance.

- Further detailed studies are required to provide definitive features of a comprehensive corridor management plan.

- A system-wide investigation is needed to balance flood management, erosion control, environmental, and other water resource purposes. Further planning studies should concentrate on a multi-objective analysis of the Sacramento River system, including re-evaluation of the existing flood management projects.

- The Reclamation Board supports a multi-objective, comprehensive corridor management plan that balances the need for flood management with other project purposes.

The final recommendation was to delay initiation of feasibility studies until The Reclamation Board completes evaluation of its capability to cost-share the study as a non-Federal sponsor. One of the site specific restoration plans, Murphy Slough, has been initiated as a Section 1135 project, and it is being implemented.

Sacramento River Flood Control System Evaluation

This effort has been ongoing since 1987 by the Corps and the State. After the flood of 1986, Congress authorized an evaluation by the Corps of the condition of the Sacramento River Flood Control Project (SRFCP). The evaluation was completed in five phases with some financial participation by DWR. Each phase covered a distinct geographical region of the river. A sixth phase was added to combine the five phases. Under this same authority, the Corps and The Reclamation Board are undertaking remediation (restoration to prior design standards) of the

project. The selection of levee sites for repair was based on incremental economic evaluations; the incremental benefits of each repair had to be greater than the associated incremental costs.

The scopes and status of the six phases are:

- Phase I (Sacramento Urban Area Levee Reconstruction Project) -- This phase of the project evaluated 110 miles of levees that protect the highly urbanized area around Sacramento near the confluence of the Sacramento and American Rivers. The Corps evaluation identified 31 miles of deficient levees in the area. Ultimately the repair of about 36 miles of levees included seepage/stability berms and slurry cutoff walls. This fix was completed in March 1993. Repair of a flood wall along the Sacramento River in Sacramento was completed in March 1997.

- Phase II (Marysville/Yuba City Area Levee Reconstruction Project) -- Phase II levee repair work consists of installing a new toe drain with stability berm facilities and levee crown and waterside slurry cutoff walls; restoring levee height; and backfilling drainage ditches in the Marysville/Yuba City area along the Feather and Yuba Rivers and their tributaries; and backfilling drainage ditches on the landside of the Sutter Bypass. Of the 134 miles of levees evaluated in this portion of the flood control project, the Corps initially identified 30 miles of deficient levees in the area. All deficient levees qualified for repairs because the benefits exceeded the cost of repair. Ultimately about 25 miles of levees were selected for needed repair. The first contract was completed in September 1996; the final three contracts were awarded in 1998. Most of the work has been completed.

- Phase III (Mid-Valley Area Levee Reconstruction Project) -- There are 240 miles of levees in this portion of the flood control project. The initial Corps evaluation identified 20 miles of deficient levees in the area. Thirteen miles did not qualify for repairs because the cost exceeded the benefits when evaluated incrementally. Currently three construction contracts will be used to restore to original design standards about 18 miles of levees north of Sacramento along the Sacramento and Feather rivers, and their tributaries. This work will correct seepage, subsidence, and instability problems around the Robbins, Verona, Knights Landing, and Elkhorn areas. The first contract for the Robbins area has been completed. The second contract was completed in October 1998. The final contract for the remaining three areas will be awarded in 1999.

- Phase IV (Lower Sacramento Area Levee Reconstruction Project) -- There are 295 miles of project levees in this area. The initial Corps evaluation identified 47 miles of deficient levees in the area. 43.5 miles did not qualify for repairs because the cost exceeded the benefits when evaluated incrementally. Currently, proposed work under this phase entails restoring to original design standards about 3 miles

of levees south of Sacramento along the Sacramento River, its tributaries, and distributary sloughs. Repair work will construct slurry walls and landside seepage/stability berms, restore levee height, and backfill levee toe ditches. The Design Memorandum was approved in February 1998. Construction will start in 1999.

- Phase V (Upper Sacramento Area Levee Reconstruction Project) -- There are 315 miles of project levees in this area. The initial Corps evaluation identified 12.4 miles of deficient levees in the area. 7.2 miles did not qualify for repairs because the cost exceeded the benefits when evaluated incrementally. Currently, proposed work is to reconstruct to original design standards about 4 miles of levees northwest of Sacramento along the Sacramento River and the Colusa Basin Drainage Canal. Landside seepage/stability berms and slurry walls will also be built. The Design Memorandum was approved in March 1998 with construction scheduled for 1999.

- Phase VI (Sacramento River Flood Control Project Levee Reconstruction) -- This phase will examine sites not identified under the previous five phases but identified after the 1997 floods. These sites also were not included for repair under PL 84-99 Cost-Shared work.

Lower Sacramento River Riparian Revegetation Study (Feasibility)

This study was a recommendation from the Fish Migration Study of the Sacramento River Reconnaissance Report. The goal of the study is to find ways to restore habitat for the endangered winter-run chinook salmon and other anadromous and resident fish species that have declined dramatically in the Sacramento River. A revegetation project was thus proposed along the lower river from Collinsville to Verona, and Sutter and Steamboat Sloughs, for about 88 miles. This proposed revegetation project would restore riparian forest and shaded riverine aquatic (SRA) habitat which are extremely low compared to historic levels. Vegetation restoration would provide shade, cover, water temperature modulation, and nutrient input required for anadromous and resident fish. The Corps and The Reclamation Board are co-sponsors of this feasibility study. Non-Federal funding will be provided by CALFED through the Category III program. Federal funding was not appropriated for FY-99. Initiation of this feasibility study is contingent on Federal appropriations and the signing of a Feasibility Cost-Sharing Agreement.

American River Flood Control Project

The Corps, The Reclamation Board, and the Sacramento Area Flood Control Agency (SAFCA) have been working on this project since 1986. The project would increase the flood protection for the City and County of Sacramento. Following the February 1986 flood, the Corps completed the American River Watershed Investigation Feasibility Report and Environmental

Impact Statement. These studies determined that the City of Sacramento, and its urban areas, were at a significant flood risk. Two alternative flood damage reduction plans were thereby identified.

The two proposed plans are (1) a flood-control-only dam near Auburn, and (2) modifications to Folsom Dam and the levees through Sacramento to increase objective flows from Folsom Dam. In the Water Resources Development Act of 1996 (WRDA 96), Congress authorized construction of features common to each of the plans. These features include stabilizing 24 miles of existing levees along the lower American River; raising and strengthening about 12 miles of levees along the east side of the Sacramento River; and implementing a telemetered stream-flow gage system and emergency flood warning system. Construction of the slurry wall in the American River levee system began in the summer of 1998.

There is strong disagreement among stakeholders as to which alternative should be adopted to provide additional flood protection for Sacramento. The lack of consensus for the American River project leaves future conditions for the basin uncertain and the populace in jeopardy.

Sacramento River Bank Protection Project

The Corps and The Reclamation Board implement the Sacramento River Bank Protection Project (SRBPP) which was authorized by Congress to maintain the design level of integrity of the Sacramento River Flood Control Project (SRFCP).

The project includes a total of 835,000 lineal feet of bank protection in two phases: 430,000 lineal feet in the first phase and 405,000 lineal feet in the second. The first phase of project construction was completed between 1963 and 1974. Work began in 1974 on the second phase authorization. A total of approximately 76,000 feet of the second phase has not yet been completed. Of this amount, 37,000 lineal feet will be completed by the end of the year 2000 for sites on the Sacramento and American Rivers. The Sacramento River Bank Protection Project Field Reconnaissance Report, completed in December 1997, identified approximately 177,000 lineal feet of eroded banks that need to be fixed. These repairs would require authorization of a third phase.

Since the project was authorized in 1960, declines in the river's biological resources, heightened public concerns about loss of habitat, and new environmental regulations have severely retarded completion of the project. The progress of the SRBPP is increasingly difficult to ensure because consensus has been difficult to achieve among the various interests regarding selection of sites, designs, and necessary environmental mitigation. Protection of the flood management system increasingly has had to rely on stopgap emergency measures to prevent levee failures.

Acceptance of, and support for, site selections which protect the integrity of the SRFCP cannot be obtained from the resource agencies until site selection and prioritization criteria are established, and a more complete evaluation of alternative erosion control measures made. This evaluation must be based on a better understanding of the flood management project performance and environmental resource values retained under various erosion control/management alternatives. Designs that incorporate environmental features are required to address environmental constraints.

Small Communities Flood Assessment, Area-Wide Assessment Study, Sacramento River Basin, California

The Corps completed this study in August 1997 to provide information on the flood damage that occurred in the Sacramento River basin from the storms of December 1996 - January 1997. This information covered twenty Sacramento River basin counties for the 1997 flood event, with flood description and damage for each county. The study also made recommendations on projects in each county that would reduce flood risks.

Feasibility Study, Yuba River Basin Investigation, California

This study was completed in January 1998 by the Corps, The Reclamation Board, and the Yuba County Water Agency. It investigated plans to provide increased flood protection for the Marysville and Linda/Olivehurst Areas. The recommended plan provides additional flood protection for three reaches in the study area. Recommended modifications are (1) constructing or deepening 6.7 miles of slurry walls, deepening 9 miles of interior toe drains, and constructing or modifying 9.5 miles of berms along sections of the Yuba and Feather Rivers; and (2) constructing about 5 miles of slurry walls and berms along the ring levee around the city of Marysville. Reaches 1 (Linda/Olivehurst) and 2 (lower Reclamation District 784) would achieve flood protection from a 200-year event, and Reach 3 (Marysville) flood protection from a 300-year event with the recommended plan in place.

Geomorphic Analysis of Sacramento River, Geomorphic Analysis of Reach From Colusa to Red Bluff Diversion Dam, River Mile 143 to Mile 243

This analysis was completed in February 1990 by the Corps. It evaluated the effects on the Sacramento River of both existing and proposed bank stabilization measures. Approximately 11,600 lineal feet of erosion protection was proposed for the reach River Mile (RM) 143 to RM 186 and 13,700 lineal feet proposed from RM 186 to RM 194.2.

The report presented 26 conclusions addressing the current channel migration and changes, channel aggradation and sedimentation, and impacts of bank stabilization on channel morphology for this reach of the Sacramento River.

Geomorphic Analysis and Bank Protection Alternatives Report For Sacramento River, River Mile (RM) 78-194 and Feather River (RM 0-28)

The Corps completed this report in May 1990, with revisions in April 1992. The report provided a detailed geomorphic analysis and bank protection alternatives analysis for the Sacramento River from Verona (RM 78) to Glenn (RM 178), and the Feather River from Verona (RM 0) upstream to the confluence with the Yuba River (RM 28). The study also included a limited investigation of the Butte Basin (RM 178 to RM 194).

The study identified 17 high priority sites for bank erosion protection. These sites comprise 27,756 lineal feet of bankline which represent approximately 8.0 percent of the total bankline. A total of 15,790 lineal feet of existing revetment has been damaged. A general bank protection plan was formulated for each study subreach that utilized the general geomorphic and hydrologic characteristics of each subreach to delineate which bank protection methods would be most applicable. A design matrix allows the most effective form of bank protection for a given site. A decision matrix can be used with the design matrix to account for considerations other than method performance. These considerations include environmental considerations, construction complexity, topbank disturbance, and life cycle costs. A radial force analysis identified sites that would be most suitable for alternative protection methods.

Sacramento River Bank Protection Project, Colusa Weir/Cobbs Bend Study

This study developed and ran a two-dimensional hydrodynamic model of the Sacramento River between RM 143.5 and RM 148. This model was then used to determine Colusa Weir performance under existing channel conditions and potential future channel conditions. Three future conditions were modeled.

The following recommendations were based on the results of the simulations, including existing conditions, two no-action alternatives, and one bank erosion remediation alternative:

- The remaining flood overflow weirs along the Sacramento River should be modeled using a two-dimensional model to more accurately determine potential flood flow rates along the Sacramento River valley. (This recommendation is prompted by the large difference between modeled and previously calculated flow divisions at Colusa Weir.);

- The pilot channel should be maintained to minimize water surface downstream of the weir; and

- Bank protection should not be placed along the bendway at RM 147 upstream of Colusa Weir unless other mitigating factors exist. If allowed to migrate, this bend will probably realign itself with the weir, thereby producing hydraulic conditions which would maximize weir discharges.

Geomorphic Analysis and Bank Protection Alternatives Report for Sacramento River, River Mile (RM) 0-78, Feather River (RM 28-61), Yuba River (RM 0-11), Bear River (RM 0-17), American River (RM 0-23), and Portions of Three Mile, Steamboat, Sutter, Miner, Georgiana, Elk and Cache Sloughs

The analysis presented the results of a geomorphic study to determine the dynamics of the studied river reaches and sloughs to develop a geomorphically-based framework upon which bank protection methods could be evaluated and overall protection strategies formulated.

The report had the following conclusions:

- Approximately 63,300 linear feet of bank on the Sacramento River were identified as high priority bank protection sites. Approximately 6,600 linear feet were identified as high priority on the Feather, Bear, and American Rivers. No high priority sites were identified on the Yuba River.

- A total of approximately 39,500 linear feet of existing revetment were identified as damaged. Damaged sites on the Sacramento River constituted high priority sites. On the Feather, Yuba and Bear Rivers, some of the damaged bank protection does not directly protect the levees, and its rehabilitation is therefore not as high a priority.

- Priority bank protection sites reflect the specific criteria utilized to define high priority status. Final determinations of sites and lengths could be revised based upon additional factors such as costs, logistics, site-specific characteristics, and engineering judgement as well as contingency factors.

- A general bank protection plan was formulated for each reach based on the general geomorphic and hydrologic characteristics of each subreach to determine which bank protection methods would be most applicable.

- A design matrix allows the determination of the most effective form of bank protection for a given site.

- Technical and environmental matrices may be used in conjunction with the design matrix to account for considerations other than technical feasibility.

The report made the following recommendations:

- The database generated thus far for a series of studies on the Sacramento River and tributaries should be integrated into a common database system and/or Geographic Information System (GIS). These data would then be retrievable and

amenable to update. A GIS format would allow incorporation of hydrographic survey data into the GIS database for analytical and graphical usage.

- The Design, Technical, and Environmental matrices developed in the report to provide a rational basis for selection of bank protection alternatives should be incorporated into a retrieval system that would permit much of the highly technical information to be used by individuals and interdisciplinary teams with less experience or a different technical background.

- A site-specific evaluation of the consequences of riparian vegetation growth in rock revetments should be conducted to determine the feasibility of relaxed maintenance standards that would allow total or partial self-mitigation. Field observations have shown that growth of woody riparian species on the rock revetments can lead to the development of riparian habitat and near-shore shading without jeopardizing the integrity of the bank protection.

- Consideration should be given to the development of high priority bank protection site identification criteria that would permit alternative types of bank protection to be implemented on an experimental basis at various locations. Monitoring the effectiveness of the alternative methods would provide a basis for evaluating their applicability.

- A hydrographic survey of the Sacramento River and sloughs from Collinsvile (RM 0) to Chico Landing (RM 194) should be completed. This survey should include a thalweg profile and a limited number of monumented channel cross sections that can be resurveyed over time in reaches where a significant amount of bank protection work is anticipated. A new survey would provide current data for use in future geomorphic and hydraulic analyses. At present, survey data used to determine channel morphometry, thalweg elevation, and hydraulic characteristics of the system are outdated.

Two additional recommendations addressed maintenance and monitoring of the Sacramento system:

- Permanent survey ranges should be established on the Feather River downstream of Marysville (RM 28) to monitor any future degradation that may occur as a result of reduced sediment supply from the Yuba and Bear Rivers. Degradation of the lower Feather River could lead to accelerated rates of bank erosion and increased threat of levee failure.

- Two-dimensional hydraulic modeling of the flood control weirs and bypasses should be conducted to identify the effects of changes in Sacramento River

planform on flow divisions. With this information, a determination could be made for the need to include a requirement for planform maintenance at the weirs in the site prioritization criteria.

SAN JOAQUIN RIVER BASIN STUDIES AND REPORTS

Reconnaissance Report, San Joaquin River Mainstem

The Corps completed this reconnaissance report in January 1993. This report evaluated the flood damage and other natural resource problems of the San Joaquin River. It identified problems, formulated and evaluated solutions to determine a Federal interest in participating in solution implementation, and decided whether to recommend appropriate future action. The report was a partial response to the authorization contained in a 1964 Congressional Resolution of the House Committee on Public Works. The study was conducted in coordination with the San Joaquin River Management Plan.

The report presented the following conclusions and recommendations:

- A continuing flood threat exists along the mainstem of the San Joaquin River, and environmental resources have seriously declined due to past water resources development in the study area.
- There is at least one feasible alternative that would increase the levels of flood protection and/or restore historic environmental resources in the San Joaquin Valley.
- The Reclamation Board has indicated a willingness and capability to cost-share the feasibility studies.
- Additional investigations and coordination are required to fully deal with constraints on the existing operation and maintenance (O&M).
- A comprehensive plan is needed for managing the riparian corridor along the mainstem.
- An investigation of system-wide reservoir operations is needed to balance flood damage reduction, environmental, and other water resource purposes.
- Future feasibility studies should assist in the comprehensive California Rivers Assessment evaluation.

The major recommendation of the report was to proceed with a feasibility study.

San Joaquin River Management Plan Report

In 1995, the State Resources Agency adopted a plan presented in a report prepared by the San Joaquin River Management Program Advisory Council. This plan report identifies measures to improve water quality, water supply, flood protection, recreation, fisheries, and wildlife habitat in the San Joaquin River Watershed. The report provides recommendations for 47 projects, 24 studies, and 3 acquisition strategies to revive the San Joaquin River system; these measures can be implemented by Federal, State, local, and individual groups, and by the Federal Central Valley Project Improvement Act sponsors.

Small Communities Flood Assessment, Area-Wide Assessment Study, San Joaquin River Basin, California

The Corps completed this study in September 1997. It provided information on the flood damage that occurred in the San Joaquin River basin from the floods of 1997. This information covered ten San Joaquin River basin counties for the flood events, with flood description and damage for each county. The study also makes recommendations on projects in each county that would reduce flood risks.

Historical Riparian Habitat Conditions of the San Joaquin River, Friant Dam to the Merced River

This report was prepared by the U.S. Bureau of Reclamation for the San Joaquin River Riparian Habitat Restoration Program. The report documents the historical and existing extent of riparian habitat along the San Joaquin River from Friant Dam to the Merced River, and it discusses the reasons for the changes in riparian vegetation over time. Mapped information is stored in a GIS database.

Analysis of Physical Processes and Riparian Habitat Potential of the San Joaquin River, Friant Dam to the Merced River

This report was prepared by the U.S. Bureau of Reclamation for the San Joaquin River Riparian Habitat Restoration Program. It describes and analyzes the physical processes affecting the San Joaquin River in the study area; determines how physical processes affect the distribution of riparian vegetation; discusses how riparian vegetation is constrained by physical conditions and current river management; and recommends feasible approaches to the future expansion or enhancement of riparian habitat.